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Comparing the Efficacy of Esmolol and Lignocaine for Attenuating the Pressor Response during Laryngoscopy and Endotracheal Intubation

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ABSTRACT

Introduction: The Pressor response characterized by tachycardia and hypertension following laryngoscopy and intubation is well-recognized, which can be hazardous in patients with cardiovascular disease as it may precipitate arrhythmias, myocardial ischemia and cerebrovascular accidents. Various techniques are currently employed to attenuate this response but so far, none have been proven to be superior .This study was conducted to compare the efficacy of Esmolol and Lignocaine in attenuating the Pressor Response to laryngoscopy and intubation.
Material and Methods: A cross sectional analytical study was conducted on 52 patients aged between 20-50 years belonging to ASA I and II scheduled for surgery under general anaesthesia after obtaining clearance from hospital ethical committee and informed consent from patients. Group (E) received 2mg.kg^{-1} of esmolol IV 2 minutes before intubation and Group (L) received 2 mg kg-1 of lignocaine 2 minutes before intubation. Haemodynamic parameters such as Heart rate, Systolic BP, Diastolic BP and MAP was compared between the two groups at induction and 1, 3, 5 minutes post induction.
Results: The demographic data was comparable between both the groups. There was a significant increase in mean HR in lignocaine group during laryngoscopy and intubation, which did not come back to baseline level even after 5 min (p value of 0). In the esmolol group, there was a significant attenuation of HR during intubation and 1, 3, 5 minutes following intubation. MAP was better controlled in esmolol group compared to lignocaine.
Conclusion: Esmolol was proven to be more effective in controlling the pressor response during laryngoscopy and intubation when compared to lignocaine.

Key Words: Esmolol, Lignocaine, General Anaesthesia, Intubation Response

INTRODUCTION

Reid and Brace first described the Pressor response during laryngoscopy and intubation in 1940 [(1)]. Pressor response i.e Tachycardia and hypertension is usually transient and seen 30 secs after intubation and lasting for < 10 min which can be hazardous in patients with pre-existing cardiovascular disease as it may precipitate arrhythmias, myocardial ischemia and cerebrovascular accidents. According to a study by Yu Et al, tachycardia and hypertension was found to be the primary cause contributing to mortality and morbidity in perioperative MI [(2)]. The mechanisms underlying the hemodynamic responses are not completely known but they have been connected to a sympathetic reflex discharge induced by upper respiratory tract stimulation [(3)]. This hypothesis is backed by the previous observation that hemodynamic reactions to

tracheal intubation are associated with increased concentrations of plasma catecholamine and are attenuated by β-adrenergic blockade [(4)].

Various techniques have been tried to reduce intubation responses in the past. Attenuation of these responses by intravenous lignocaine were found effective in some studies and less reliable in some [(5-8)]. Use of esmolol was found to be effective in blunting pressor response and provided hemodynamic stability in risk patients in various studies [(9,10)].

The main aim of this study was to evaluate the efficacy and effectiveness of intravenous lidocaine and esmolol in attenuating hemodynamic responses with respect to Heart rate, SBP, DBP and MAP to laryngoscopy and intubation in normotensive patients undergoing elective surgeries under general anaesthesia requiring endotracheal intubation.

MATERIALS and METHODS

A cross-sectional, analytical study was carried out after obtaining Father Muller Hospital Ethical Committee clearance through 2019-2020 and written informed consent from the patients. Normotensive patients scheduled for surgery under general anaesthesia in the age group of 20–50 years of both sexes and the American Society of Anaesthesiologists physical Status I and II were included in the study. Patients suffering from comorbidities, predicted difficult intubation, prolonged laryngoscopy and intubation, and head and neck surgery, History of allergy to any drugs used in the study, Emergency surgical procedures, Patients on beta blockers and calcium channel blockers were excluded from the study.

The study population of 52 were selected and divided into 2 equal groups

Group Esmolol received 2 mg/kg of Inj Esmolol IV

Group Lignocaine received 2mg/kg of Inj lignocaine IV

SAMPLE SIZE ESTIMATION

Sample size was calculated at 95 % Confidence Interval and 90% Power

$$n = \frac{2(Z_\alpha + Z_\beta)^2 \sigma^2}{d^2}$$

Z_α =1.96 at 95% Confidence interval
Z_β =1.281 at 90% power
d = clinically significant difference between two parameters. Sample size taken in each group was 26.

PROCEDURE

After obtaining Hospital Ethical Committee clearance, 52 patients who met the inclusion and exclusion criteria was enrolled for this study. A written informed consent was taken from all the patients. Patients were kept nil per oral for solids and liquids 6 hours prior to surgery. Patients were premedicated with diazepam 5mg and ranitidine 150mg per oral on the previous night.

Patients on arrival to operation theatre basal parameters were recorded and were premedicated with injection glycopyrrolate 0.01 mg/kg and injection midazolam 0.05 mg/kg 5 min before induction. Patients were preoxygenated for 3 minutes, induced with Inj propofol 2mg/kg following which ventilation was checked once confirmed injection vecuronium 0.1mg/kg was given to facilitate intubation and ventilation. Patients either received inj esmolol 2mg/ kg or inj lignocaine 2mg/kg two mins before laryngoscopy and intubation as decided by the treating anaesthetist. Laryngoscopy was performed with a Macintosh laryngoscope blade and trachea was intubated by the same trained anaesthetist with an appropriate-size endotracheal tube within 15–30 s in the first attempt and anaesthesia was continued with O_2, N_2O, isoflurane.

Events from the time of injection of study drugs up to 5 min after intubation were recorded. Analgesics were administered after the study period. At the following times on arrival to operation theatre, during laryngoscopy and intubation,

and after 1, 3, and 5 min of intubation, HR, SBP, DBP and SPO2 readings was noted and MAP was calculated. Patients were monitored for conduction abnormalities, ST-segment changes with electrocardiography monitoring, hypotension, bradycardia, bronchospasm, and pain on injection. At the end of the surgery, the patients were reversed with injection neostigmine 0.05 mg/kg and injection glycopyrrolate 0.01 mg/kg. Patients were followed up postoperatively for complications.

STATISTICAL ANALYSIS

The collected data were analyzed using proper statistical tests such as Student's *t*-test, and data were represented by mean SD and graphs. Data were analyzed using statistical software SPSS version 17. $P \leq 0.05$ was considered as statistically significant.

RESULTS

Table 1 : Demographic Data

	Group	N	Mean	Std. Deviation	t test p value	
age	Esmolol	26	39.58	6.204	.931	NS
	Lignocaine	26	39.73	6.533		
weight	Esmolol	26	61.04	10.978	.950	NS
	Lignocaine	26	60.85	10.825		
height	Esmolol	26	167.15	7.908	.693	NS
	Lignocaine	26	168.00	7.473		

From the above data it shows that there was no statistically significant difference in demographic data such as age, weight and height among the two groups.

TABLE 2: Heart rate variability between Esmolol and Lignocaine.

Parameter			N	Mean	Std. Deviation	95% Confidence Interval for Mean		t test p value	
						Lower Bound	Upper Bound		
HR	**baseline**	Esmolol	26	82.54	6.59	79.47	86.6	0.052	NS
		Lignocaine	26	79.81	6.3	77.26	82.35		
		Total	52	82.67	7.01	80.72	84.62		
	induction	Esmolol	26	81.04	6.95	78.23	83.85	0	HS
		Lignocaine	26	90.73	4.6	88.87	92.59		
		Total	52	85.88	7.62	83.76	88.01		
	1min	Esmolol	26	78.54	6.98	75.72	81.36	0	HS
		Lignocaine	26	98.73	6.86	95.96	101.5		
		Total	52	88.63	12.28	85.21	92.05		
	3mins	Esmolol	26	76.62	6.63	73.94	79.29	0	HS
		Lignocaine	26	102.88	6.59	100.22	105.55		
		Total	52	89.75	14.79	85.63	93.87		
	5 mins	Esmolol	26	77.15	6.73	74.43	79.87	0	HS
		Lignocaine	26	99.35	6.56	96.7	102		
		Total	52	88.25	12.99	84.63	91.87		

The baseline Heart rate was comparable between the two groups. There was a significant increase in mean HR in lignocaine group during laryngoscopy and intubation, which did not come back to baseline level even after 5 min (p value of 0). In the esmolol group, there was a significant attenuation of HR during and following intubation.

The SBP and DBP was well controlled in esmolol group when compared to lignocaine group, the rise in SBP and DBP following intubation did not return to baseline even after 5minutes post intubation.

Table 5 : Changes in Mean Arterial Pressure

Parameter			N	Mean	Std. Deviation	95% Confidence Interval for Mean		t test p value	
						Lower Bound	Upper Bound		
MAP	**baseline**	Esmolol	26	93.5	3.44	92.11	94.89	0.053	NS
		Lignocaine	26	91.08	4.25	89.36	92.79		
		Total	52	92.29	4.02	91.17	93.41		
	induction	Esmolol	26	90.42	3.4	89.05	91.79	0	HS
		Lignocaine	26	100.12	4.11	98.45	101.78		
		Total	52	95.27	6.16	93.56	96.98		

	Table Continued								
	1min	Esmolol	26	88.27	3.28	86.94	89.59	0	HS
		Lignocaine	26	103.42	4.33	101.67	105.17		
		Total	52	95.85	8.54	93.47	98.22		
	3mins	Esmolol	26	86.65	3.49	85.25	88.06	0	HS
		Lignocaine	26	106.65	4.52	104.83	108.48		
		Total	52	96.65	10.86	93.63	99.68		
	5 mins	Esmolol	26	86.04	3.36	84.68	87.4	0	HS
		Lignocaine	26	103.15	4.48	101.35	104.96		
		Total	52	94.6	9.49	91.95	97.24		

The MAP following induction, 1, 3 and 5 minutes in the esmolol group was 90.42, 88.27, 86.65 and 86.04. There was a significant fall of the hypertensive response to laryngoscopy and endotracheal intubation Mean of MAP in lignocaine group showed a significant rise from baseline values, especially during and 1 and 2 min after laryngoscopy and endotracheal intubation.

DISCUSSION

The hemodynamic response characterized by tachycardia and hypertension during laryngoscopy and intubation, is well-recognized. Stimulation of mechanoreceptors in the pharyngeal wall, epiglottis and vocal cords, is thought to be the cause for this hemodynamic response. Various techniques were used to reduce pressor response such as use of topical lignocaine spray, maintenance of deep plane of anaesthesia by intravenous (IV) opioids, calcium channel blockers, and vasodilators, but none of these techniques were ideal and the search for a perfect agent is continuing.

Lignocaine has been a commonly used agent for attenuating pressor responses. Lidocaine's beneficial effect is due to its direct cardiac depression and peripheral vasodilation, ability to suppress airway reflexes due to irritation of tracheal mucosa, bronchodilation, analgesic as well as antiarrhythmic properties. A study done by Wilson *et al*. stated that IV lignocaine is beneficial in preventing the hemodynamic changes to laryngoscopy and intubation [(11)]**.** However, recent studies have questioned efficacy of lignocaine in suppressing pressor response. In studies conducted by Singh et al [(12)] van den Berg et al [(13)] and Kindler et al [(14)]**.** IV lignocaine 1.5 mg/kg was not found to be effective.

Esmolol is a cardio-selective β-adrenergic antagonist with fast onset of action permits for intraoperative use. It blocks the β-adrenergic receptors and reduces the force of contraction and heart rate. Varying doses of esmolol 0.5-2 mg/kg have been used in the past. Mulimani SM et al [(15)], conducted a study on 60 patients comparing the Efficacy of a Bolus Dose of Esmolol and Bolus Dose of Lignocaine for Attenuating the Pressor Response to Laryngoscopy and Endotracheal Intubation in General Anaesthesia. The mean pulse rate, MAP, and RPP at intubation and at 1, 2, 3, and 5 min after intubation in the lignocaine group showed a substantial increase in these values, but in the esmolol group it stayed similar to or below baseline values. They concluded that esmolol was effective in suppressing intubation response in comparison to lignocaine which was similar to our results. Figueredo E et al [(16)]**,** compared esmolol with placebo on the haemodynamic changes elicited by laryngoscopy and tracheal intubation (LTI). They concluded that Esmolol is effective, in a dose-dependent manner, in the attenuation of the adrenergic response to LTI which was similar to our study.

There was no complication observed in the perioperative period in any of the groups.

Limitations of this study

The Calculated sample size used was small.

Invasive arterial line monitoring was not used which would give a real time, beat to beat monitoring of blood pressure.

CONCLUSION

In this study we compared the efficacy of esmolol and lignocaine for attenuating the pressor response during laryngoscopy and endotracheal intubation. We conclude that bolus dose of intravenous esmolol 2mg/kg was more effective in blunting the pressor response when compared with intravenous lignocaine 2mg/kg under general anaesthesia.

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